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ABSTRACT

This booklet is designed to interest and recruit high school females for a career in engineering. Descriptions of employment opportunities, work responsibilities, and the engineering program at Stanford University are included. Quotes from women engineering students accompany photographs of student life at Stanford. Also provided are short biographies of successful women engineers and those personality characteristics that they share. (MA)

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The Stanford University School of Engineering . . .

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WOMEN IN ENGINEERING . . .

As the father of four college-age girls, I am well aware of the career ambitions of today's women, as well as the dilemma facing them when attempting to choose a vocation. The days when schoolteaching provided an unlimited source of opportunities are apparently over, and the number of both men *and* women who think they are going into law and medicine already exceeds the capacity of these graduate schools several times over. Jobs in journalism are not easy to get, and a successful career in any of the fine arts is reserved for those few with exceptional talent. How many women do you know who have majored in English or history and are now pounding a typewriter?

The idea of women in engineering does not seem to be a bizarre one in many foreign countries, and the fact that engineering as a career for women has not been investigated by many women in this country seems to stem primarily from cultural conditioning. Perhaps it is worthwhile for you to think about it.

If you were able to hold your own in mathematics in high school, or did reasonably well on the quantitative aptitude test (640 on the Math II Achievement Test), you probably have the talent.

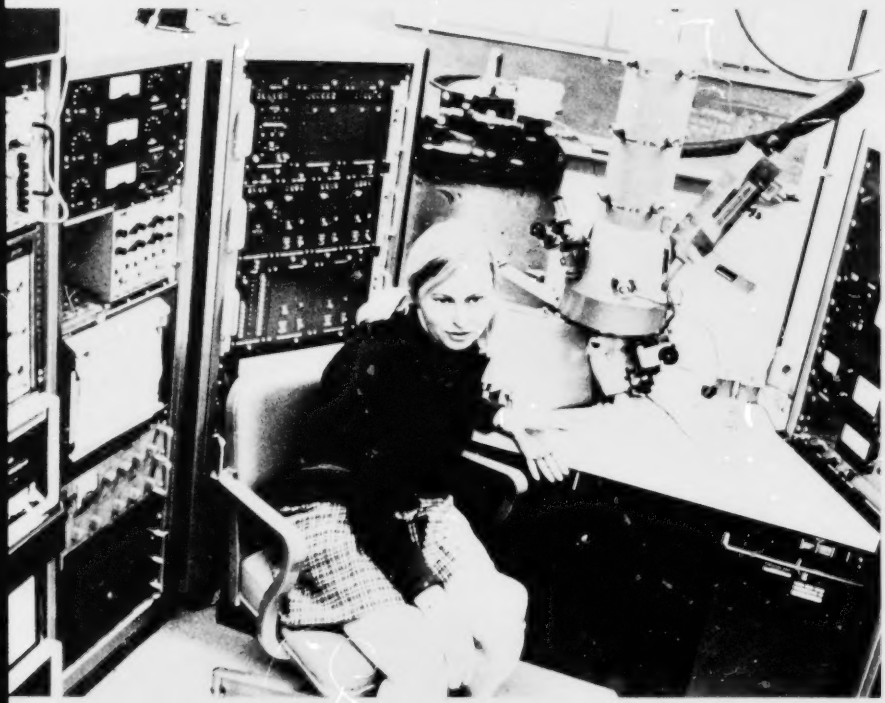
The notion that there is a surplus of engineering graduates in the job market is a well-publicized myth. The fact is that the market for Stanford engineering graduates has held up remarkably well through the recession, and all reliable predictions point out that there will be twice as many engineering jobs available by 1976 as there will be graduates. Now is the perfect time for women to break some new ground. The majority of engineering jobs are perfectly suitable for women, although admittedly a few men will not readily agree to that. But engineering presents no more problems to a woman than any other male-dominated profession such as law, business, or medicine. Like it or not, you live in a highly technological society; technology is not going to go away, and you should be a part of it, rather than leaving it all up to the men.

Engineering is one of the very few undergraduate majors at Stanford that is professional in character, and thus leads to a bachelor's degree that is a ticket to a well-paying job without further graduate work. However, one more year's work for a master's degree, and you are at the optimum level to do sophisticated technical work with substantially greater personal and financial rewards. You might well consider whether you can afford the luxury of devoting your undergraduate years to finding yourself, or whether you might be better advised to start moving toward a professional career at the very beginning. Struggling with calculus and physics problems and exploring the world of ideas while your classmates are doing the latter may be strenuous, but it also might just be worth it. The unique thing about Stanford is that you can really do both to a considerable degree if you desire. An engineering education is also a good preparation for entry into the professional schools of law, business, medicine, or engineering.

Please come by our office—Room 271, at Engineering Corner—or write to me for any further information you require.

Yours truly,

William M. Kays, Dean



Design a Wheelchair That Can Climb Stairs.

Design a Non-Polluting Engine.

Design a Self-Contained Incubator To Transport Premature Babies.

IF the problems intrigue you, so might the career. A woman in engineering? Why not?

Only about 7,000 of the 760,000 engineers in the U.S. today are women, but the field is rapidly opening for the adventurous young woman. More women engineers are being graduated every year.

What does a professional engineer actually do? With eight major branches of engineering, and perhaps a hundred sub-branches, there is no easy answer to that question.

The work of an engineer can be the highly theoretical study of the behavior of fluids or solids, or applied research involving the design and construction of duplex apartments, an improved computer, a bridge, or an artificial heart.

An engineer in computer science may do purely mathematical work, concerned with the logical process on which the operation of the computer is based, or her work may concentrate on the engineering problems of the "hardware"—the design and use of the computer itself.

An industrial engineer most often works with people, trying to assure their efficiency by educating workers to the place of their own work in the whole process of producing a car, or a space ship. Alternately, an industrial engineer may spend her working days adapting the design of machinery to the abilities of the human beings who will run it.

An electrical engineer developed a reading machine which frees

Engineers are actively engaged in solving society's problems instead of just discovering new knowledge that may or may not have an eventual application.

There is great satisfaction in seeing some tangible output of your own work. That is, most engineering work culminates in some actual thing.

There's nothing inherently feminine about mixing a given batch of materials, exposing it to a definite temperature for a definite time, and producing a cake. There's nothing inherently masculine about mixing a batch of materials, exposing it to a definite temperature for a given time, and producing iron castings. I've done both, and find them satisfying occupations.

Quotations in the margins are from women engineering students.

There was no snide reaction from other girls when I told them I was in engineering. They were surprised and respectful, maybe because they weren't willing to put out that kind of effort themselves.

blind people from dependence on braille texts by making any printed matter readable through the conversion of letters to patterns that can be felt on the fingertips.

Women engineers can be found designing miniature electronic circuits, or medical instrumentation, or devices to monitor, prevent, or clean up pollution.

If you want to know more about the range of work in engineering, browse through the engineering section of your school or public library, or look around for engineers who can talk to you about their work. You probably won't need to look far.

You've never heard of a woman engineer? Actually, you probably have heard of at least one—Dr. Lillian M. Gilbreth. She was the famous mother of 12 in *Cheaper by the Dozen*, who pioneered with her husband, Frank Gilbreth, in the field of motion study, from which the profession of industrial engineering has evolved.

You think the work might interest you? But how do you begin?

All human beings are engineers from the time they begin to walk. Engineering involves the definition of problems and attempts to solve them. The toddler learning to tie his shoes, the schoolchild building a crane with tinkertoys, the teenager learning to make a dress—all are involved in what might be called an engineering process.

Far more women have an aptitude for engineering than are actually going into the field. Studies indicate that if all the women who had the aptitude went into engineering, there would be nearer 500,000 than the 7,000 women engineers.

Mechanical aptitude is far less important in a modern engineer than mathematical ability, a flair for problem solving, and a taste for hard work. Physical stamina, however, is rarely required.

A lot of my old girlfriends were good in science and math, but they never considered going into engineering because they felt it was a rugged occupation with a "for men only" label. No one ever told them that most engineering jobs are no more unladylike than chemistry, for instance. Actually, I didn't know very much about engineering either, but I thought I liked applied science even better than pure science, and I refused to believe that engineering could be as rugged and exclusively masculine as all that.

Many of the problems I was solemnly warned about—for instance, the alleged difficulty of lugging heavy equipment around on engineering laboratory courses—just never materialized.

"When I was twelve years old, I had already decided that I wanted to be independent. I wanted training to do work I liked, work which had no upper limit."

Irmgard Flügge-Lotz speaks very firmly, out of a lifetime of experience and satisfaction with her work as an engineer. She has had several careers, starting out as an aero-dynamicist, concerned with the dynamics of flight and navigation, then working on fluid mechanics, and on controls, and finally as a teacher and researcher at Stanford. She is now an emeritus professor of applied mechanics and of aeronautics and astronautics, but still at work in her chosen fields.

After receiving her doctorate from the Technische Hochschule (Technical University), Hannover, Germany, Professor Flügge-Lotz went to the Göttingen Aerodynamics Institute, which was at that time the most famous aerodynamics institute in the world. By 1938 she was the head of the Department of Theoretical Aerodynamics, with ten Ph.D.'s working under her and her own computation center.

"Engineering was unbelievably fascinating to me," says Professor Flügge-Lotz. "I was seeing enormous development in the field of aerodynamics, and I wanted to go into that field. Early I wrote some papers that got published and used, and I got acquainted with many of the people in the field."

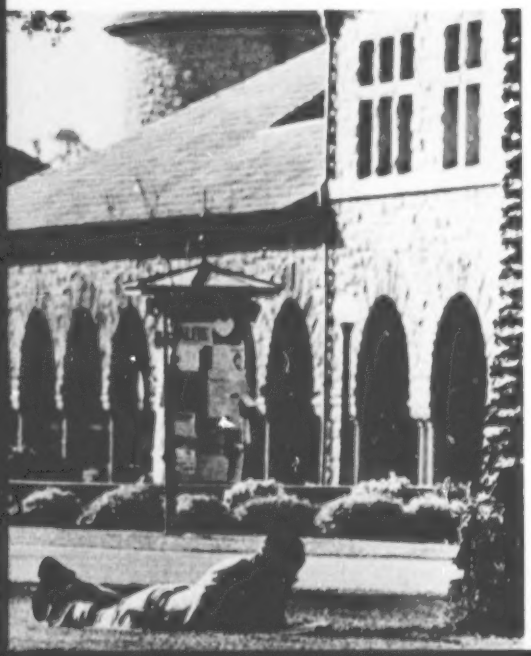
One of the people she met during this period was the man who became her husband, Wilhelm Flügge. He too is an engineer, with a distinguished career in the field of structural analysis.

Reflecting on her career, Professor Flügge-Lotz comments, "You cannot say that engineering is a male occupation—what is 'male' about electronics? But I have thought that it was much easier to find real human understanding in the new engineering fields."

"Most of the people I worked with were men," she adds. "It doesn't make difficulties as long as you make clear that the floor of your office is not a dance floor. The important thing is to have the same knowledge as a man, and to be cooperative. I never learned to type; I came on my job to use mathematical equations for describing technical problems, and that's what I did."

What has been the most satisfying aspect of her work? "Having an interesting problem that has resisted being solved, and then solving it.

"I wanted a life which would never be boring. That means a life in which new things occur. And it has been a life full of work."



Engineering is essentially an intellectual profession; most engineers work in an office.

If you have enjoyed high school courses in mathematics, physics, and chemistry, you may want to investigate the engineering curriculum at the universities to which you are applying. Engineering seems especially attractive to women who enjoyed high school math and science courses and who may prefer practical to theoretical work. Engineering is the central discipline for the application of technology to the solution of societal problems.

The Stanford School of Engineering counted 46 women among its 637 engineering undergraduates in 1972. Forty-three women that same year were pursuing a graduate degree in engineering. Civil engineering, architecture, and urban design are the most popular programs for undergraduate women, while operations research and electrical engineering attract the most graduate women.

A student who enters Stanford as a freshman, intending to major in engineering, should have taken as much mathematics as her high school offers. High school courses in physics and chemistry are strongly recommended but not required.

Stanford is one of the three top-rated engineering schools in the country, according to the American Council of Education ratings in 1969. As such, the School of Engineering offers a wide variety of departmental majors. The basic fields are chemical, civil, electrical, industrial, materials science, and mechanical engineering. Interdisciplinary fields include aeronautics and astronautics, applied mechanics, engineering science, product design, and resource strategy.

The School also offers undergraduates the opportunity to propose a unique combination of courses to meet particular career goals. Some

There is something very nice about being on a co-educational campus. Even though at Stanford you're one of only two or three women in a class, once you step out of Engineering Corner, you're surrounded by other women students.

I came to Stanford because I would get both a good engineering education and all the benefits of a good liberal arts school in a great environment.

One of my outstanding impressions about engineering at Stanford is the flexibility of the curriculum, in which the student is encouraged to arrange individual correlations between fields; for example, between biology and engineering.

Dylan

possibilities are environmental engineering, urban planning, and ocean engineering.

It is possible to explore a number of options, including engineering, during your freshman year. Stanford's School of Engineering is an integral part of a University which also provides a strong liberal arts program, one of the best in the nation.

For an engineering undergraduate, more intensive work begins in the sophomore year. The third and fourth years allow moderate specialization in the engineering field of your choice. At the same time, you will gain the same liberal arts background as do students in other departments.

Timing is also flexible in the engineering undergraduate program. (It is easy to design your program so that you may take advantage of the opportunity to study at one of Stanford's five overseas campuses.) It is possible to drop out for a term or two, or to accelerate your program by summer study.

The life of an engineering undergraduate is a demanding one. Math and science courses require a good deal of application, and that means long hours of study. But you will have the satisfaction of knowing that you are establishing the solid basis for a professional career.

Women students do face some special problems in engineering as they do in other professional fields. Although the Stanford School of Engineering welcomes women, their number is still proportionately few. It may take a bit longer to find friends among your classmates, but there can develop a special camaraderie with some. As with other groups in the minority, women engineers often have a special rapport with one another.

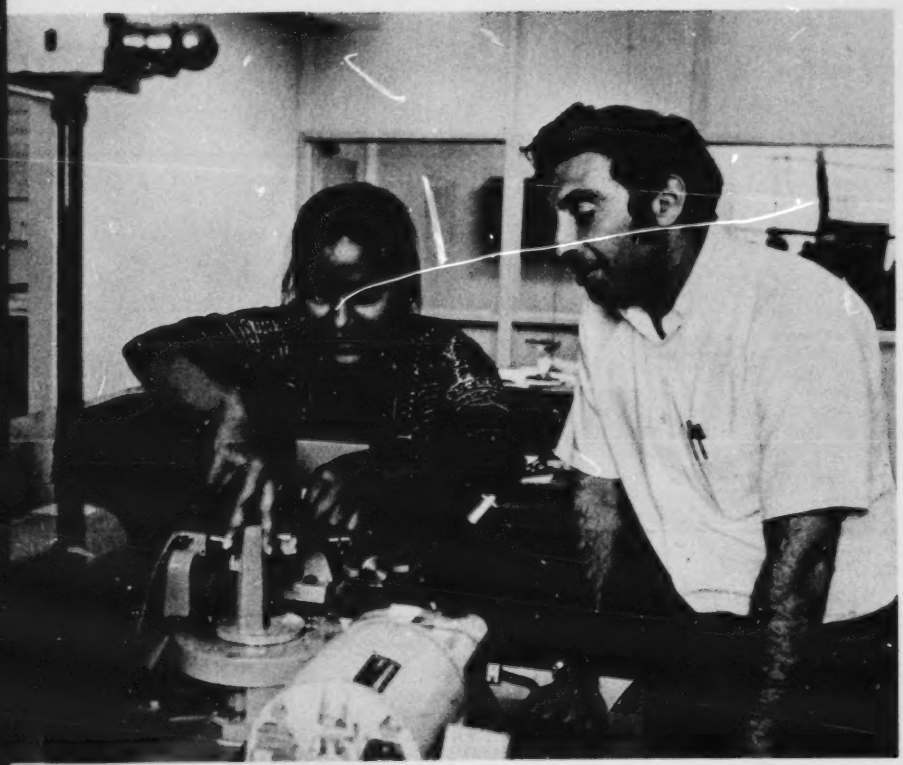
A woman who decides to go into engineering is a person with drive, determination, and staying power. When she graduates with an engi-

Stanford is a pioneer in courses combining technology and society.

Dorm life was more hectic. I usually had more hours in class and more homework than my fellow co-eds, but I managed to survive and even find time for an occasional party.

There is a lot to the idea that people one meets while studying engineering at Stanford will be lifelong contacts in the profession. And Stanford graduates seem to do very well.

Assistant Professor Lily Young
Civil Engineering



Assistant Professor Patricia Jacobs
Operations Research

neering degree, she will find that numerous rewards await her. Engineering is among the most highly paid professions for women. A woman can choose from career opportunities in large and small industries, in government—federal, state, and local—as well as in colleges and universities, in a variety of locations in America and abroad.

Most women engineers work throughout their professional lives. A woman engineer is as likely to marry as a woman in a more traditional profession, but she is more likely to remain married. Her husband is likely to be another professional. Because of the wide variety of opportunities open to an engineer, a married woman engineer often finds combining her career with family life somewhat easier than do other professional women.

I wanted a life which would never be boring. That means a life in which new things occur. And it has been a life full of work.
—Prof. Irmgard Flügge-Lotz

Scholarships are available for high school women who want to go into engineering. High school counselors can be asked to provide or help seek information about scholarships available from national societies of engineers. Local societies of engineers may be especially helpful in providing information about local level competition for national scholarships.

If you want to learn more about engineering:

- Talk to your high school or college counselor.
- Write to the Society of Women Engineers
  United Engineering Center, Room 305
  345 East 47th Street
  New York, New York 10017
- Write to the School of Engineering
  Stanford University
  Stanford, California 94305